## NEW BOOKS

**The Place of the Elementary Calculus in the Senior High School Mathematics; and Suggestions for a Modern Presentation of the Subject.** By NOAH BRYAN ROSENBERGER, Ph.D. Columbia University. Contributions to Education No. 117. vii. 81 pp. Columbia University, New York, 1921.

This little book is a carefully studied argument, well attested by facts, for the teaching of elementary calculus in the last high school year—in the twelfth grade. Perhaps the author would say it is a demonstration rather than an argument. The style is what Bertrand Russell would call apodeictic.

First it is proved that our schools are behind the schools of many other countries in mathematical achievement; then that reforms already begun here leave room where a new subject can be put; and finally, that the calculus is important enough to be put there. This much occupies nineteen pages, and is very much to the point.

Then the little book takes up the question of presentation. First, on the ground that "in many ways the mental development of the child follows the mental development of the race"; next, on the precedents estabished by recent text-books intended for students of this age or not much older; and finally, on the ground that the brighter of our pupils need more vigorous food, and that this particular form of educational activity can fulfil the essential condition of forming habits that the student will desire to maintain and strengthen throughout his lifetime,—on these three bases the author founds his presentation, which is indicated by the following order of topics:

1. The derivative. 2. The slope of the tangent. 3. Maxima and minima. 4. The differential. 5. Integration. 6. The definite integral (under topics 5 and 6 is included the area under a curve). 7. The length of an arc. 8. The volumes of certain solids (cylinder and cone—of revolution—and sphere).

The problems given to illustrate the author's method of presentation are bravely called practical; the reader must be generous. There is a little haziness about the astronomical information on page 56, and about the printer's problem on page 67.

The Labrador missionary of page 58 must have a very long straight beach, and make a lightning change on and off with his skiis. The graphs and integrals are all parabolas. The solids considered in finding volumes are the cylinder and cone of revolution and the sphere.

Too much definiteness should not be expected of a book that calls itself "a suggestion." On the other hand, it might well stimulate other suggestions. For one, is it wholly desirable to omit entirely the idea of a limit from the teaching preceding the calculus? It has been badly done, to be sure,—too early, and in an unnecessarily complicated way. Bad as it was, it seems now about to be wholly replaced by a method compounded of conjecture and hope. Without previous use of the limit idea, we run into difficulties; for instance, at the foot of page 78, our author applies the formula for $\int ds$ to the arc of a circle, obtaining as a result the value upon which his data depend. Applying the historical criterion, the strict evaluation of $\pi$ might be put before the calculus.

Again, if we are to find warrant in history for the development of our teaching, we might take account of the period of Kepler, Cavalieri, and John Wallis. The experience of our pupils in graphs ought to make it possible to explain to them a "curve of sections" of any solid, to "prove" to them that the area of this curve of sections is numerically equal to the volume of the solid, and thus to get Cavalieri's Theorem in as a basis for solid geometry mensuration.

Turning to the author's account of the eleventh school year, we find maxima and minima by means of graphs, and some of the simpler properties of conics. Why not teach the derivative there? Certainly the practice of foreign schools should encourage us.

If we can scatter some of the fundamental ideas and devices of the calculus in the preceding work of the pupil, we shall avoid the feature which made the "Advanced Algebra" of previous years distasteful—namely, its heterogeneous character. "It is important that the student should feel that he is doing something," not merely getting ready.

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